WHAT IS CLAIMED IS:

1. A timing extractor for extracting a timing component for determining a symbol from a digital modulated signal having a symbol rate fs, comprising:

a frequency converting means for converting positive and negative frequency components of fs/2 included in a complex baseband signal to a frequency position fm ($0 < |fm| < fs/2$), the complex baseband signal being obtained from the digital modulated signal and formed from an I signal and a Q signal;

a nonlinear processing means for at least squaring the I signal and the Q signal resulting from frequency conversion by the frequency converting means; and

a frequency extracting means for extracting from an output signal of the nonlinear processing means a frequency component 2fm, i.e., a frequency component which is twice the frequency position fm, and outputting the extracted frequency component as a timing signal.

2. The timing extractor according to claim 1, wherein the frequency position fm is $|fm| = fs/2M$ (where M is an integer of at least two).

3. The timing extractor according to claim 2, wherein $M = 2$ and the frequency position fm is $|fm| = fs/4$.

4. The timing extractor according to claim 2, wherein $M = 4$ and the frequency position fm is $|fm| = fs/8$.

5. The timing extractor according to claim 1 or 2, wherein the frequency converting

means includes a filtering means for removing in advance from the complex baseband signal a frequency component which will become an aliasing distortion component for the frequency component 2fm included in the output signal of the nonlinear processing means.

6. The timing extractor according to claim 1, wherein the frequency converting means includes a first frequency shifting means for shifting a frequency of the complex baseband signal in a frequency increasing direction, and a second frequency shifting means for shifting a frequency of the complex baseband signal in a frequency decreasing direction.

7. The timing extractor according to claim 1, 2 or 6, wherein the frequency converting means includes a frequency shifting means for shifting a frequency of the complex baseband signal in a frequency increasing direction and a frequency decreasing direction by fs/2.

8. The timing extractor according to claim 1, wherein the frequency converting means includes a bandpass filtering means for extracting the positive and negative frequency components of fs/2 included in the complex baseband signal.

9. The timing extractor according to claim 3, wherein the frequency converting means includes a numerical operation means for calculating upon every two samplings a true value multiplied by $\sqrt{2}$ as the positive and negative frequency components of fs/2 converted to the frequency position fm.

10. The timing extractor according to claim 9, wherein the nonlinear processing

means includes two multiplying means for squaring the I signal and the Q signal resulting from frequency conversion by the frequency converting means, respectively, an adder for adding the I and Q signals squared by the multiplying means, a bit shifting means for multiplying an output of the adder by 1/2, and a selecting means for selecting the output of the adder or an output of the bit shifting means.

11. The timing extractor according to claim 1 or 2, wherein the frequency extracting means outputs the timing signal once every L times when the frequency position fm is $|fm| = fs/(2^2 \times L)$ (where L is an integer of at least one).

12. The timing extractor according to claim 6, wherein the first and second frequency shifting means each includes a filtering means for removing in advance an interference component which is present in the frequency position fm.

13. The timing extractor according to claim 6, wherein the frequency converting means complex adds respective outputs of the first and second frequency shifting means.

14. A method for extracting a timing component for determining a symbol from a digital modulated signal having a symbol rate fs, comprising the steps of:

converting positive and negative frequency components of fs/2 included in a complex baseband signal to a frequency position fm ($0 < |fm| < fs/2$), the complex baseband signal being obtained from the digital modulated signal and formed from an I signal and a Q signal;

at least squaring the I signal and the Q signal resulting from the frequency

conversion;

adding the squared I and Q signals; and

extracting from the added signal a frequency component 2fm, i.e., a frequency component which is twice the frequency position fm, as a timing signal.

15. The method according to claim 14, wherein the frequency position fm is |fm| = fs/2M (where M is an integer of at least two).

16. A demodulator, comprising:

an antenna for receiving a digital modulated signal;

a semi-synchronous wave detecting means for quadrature-detecting the digital modulated signal received by the antenna to obtain a complex baseband signal formed from an I signal and a Q signal;

an A-to-D converting means for converting the complex baseband signal obtained by the semi-synchronous wave detecting means from analog to digital values; and

the timing extractor according to claim 1, wherein

the digital complex baseband signal obtained by the A-to-D converting means is sampled at a sampling frequency 2fs based on a timing signal from the timing extractor, whereby demodulated data is obtained.